

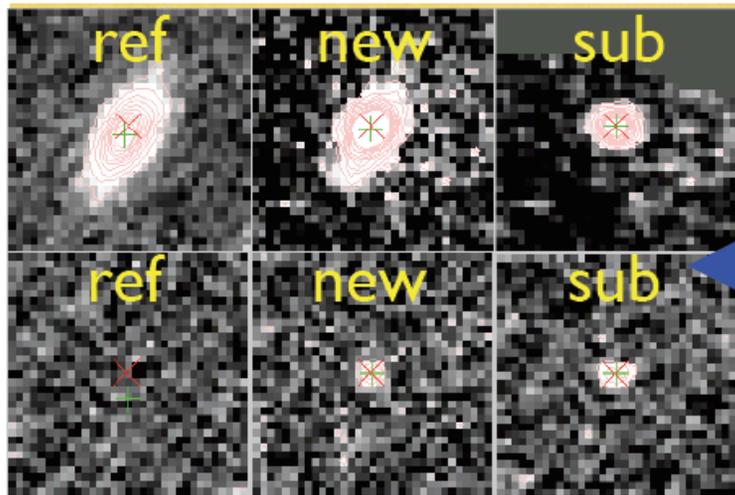
DeepSky: Science Gateway Service

Peter Nugent

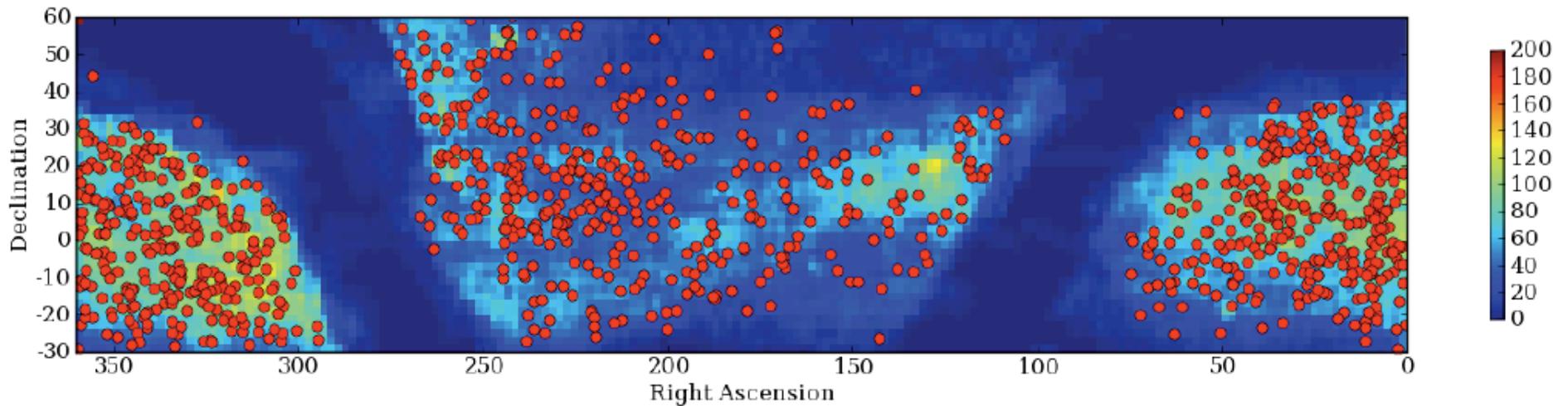
NERSC User Group Meeting
October 7, 2009



SNfactory & Palomar-QUEST



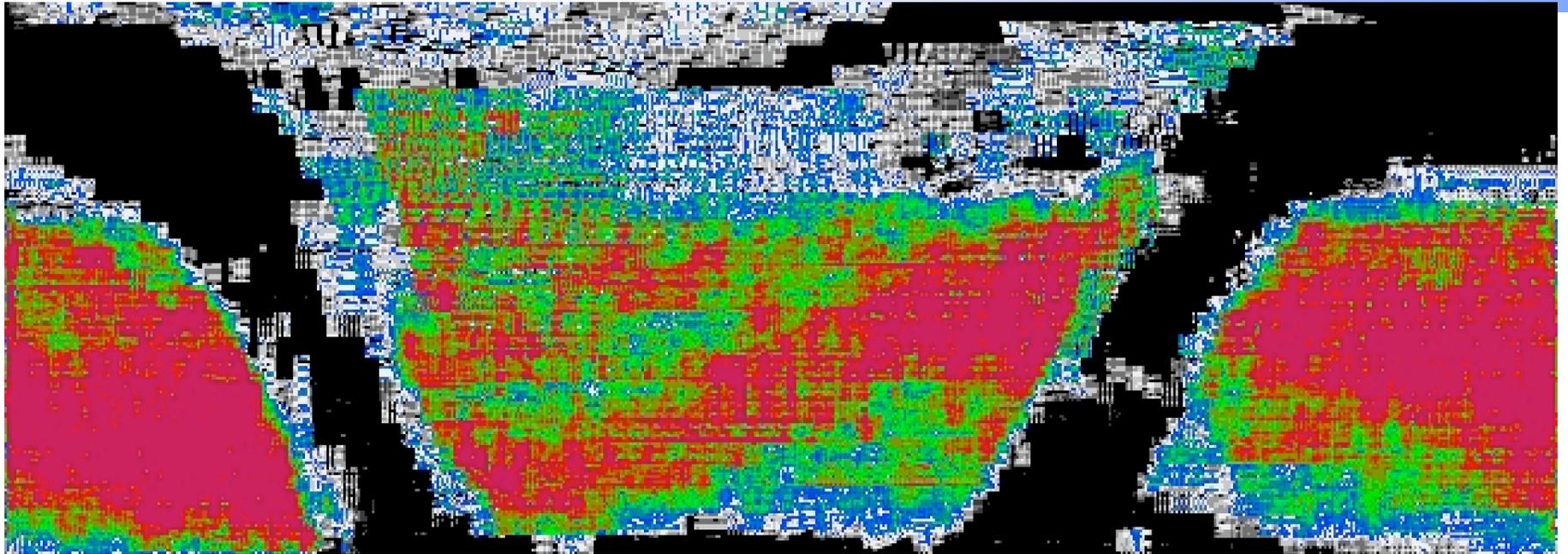
SNfactory & Palomar-QUEST



Discovered over 1000 SNe of all types (show in red above) all over the northern night sky.

But what about all that imaging data.....

DeepSky Data



This data spans 9 years and almost 20,000 square degrees, half from the NEAT 3-banger and half from the Palomar-QUEST camera on the Palomar Oschin schmidt telescope. The entire dataset is 75 TB and creates both a temporal and static catalog of astrophysical objects. NERSC has re-processed and hosts this data on NGF - 11.5M images.

DeepSky Archive

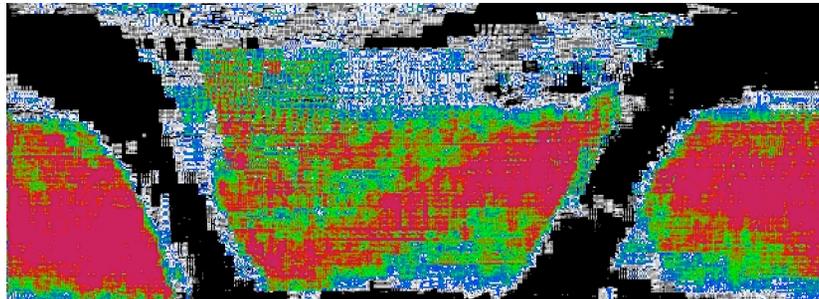


Jacquard
712 cpus 2 GB ram/cpu

*Science Gateway Nodes
DeepSky Database*

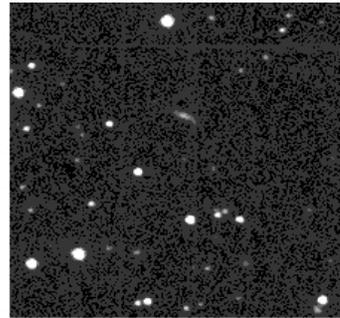


Davinci
32 cpus 192 GB ram shared

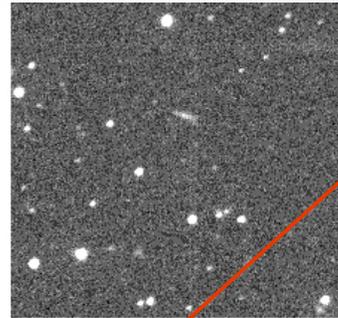


NGF - 90TB IBM's GPFS

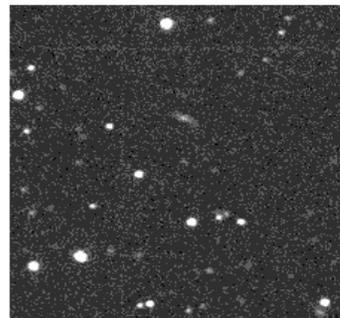
DeepSky Database



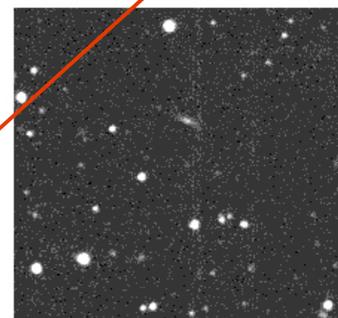
deep reference image (258, 27)



component image



component image



component image

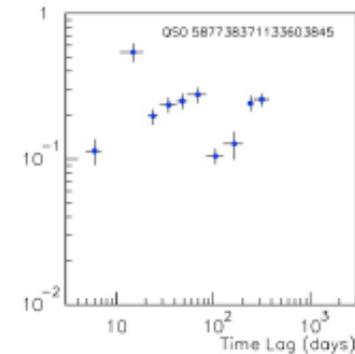
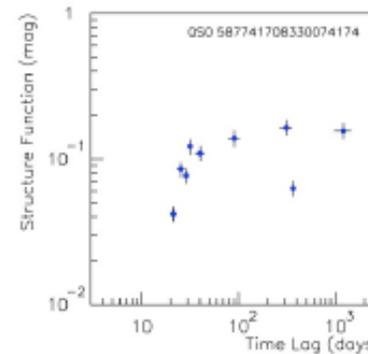
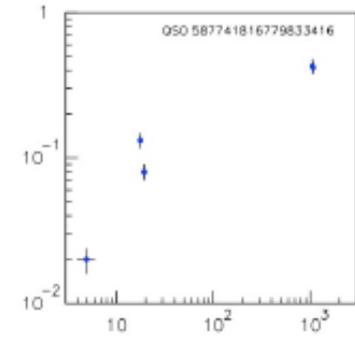
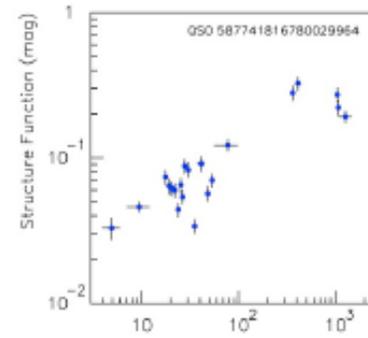
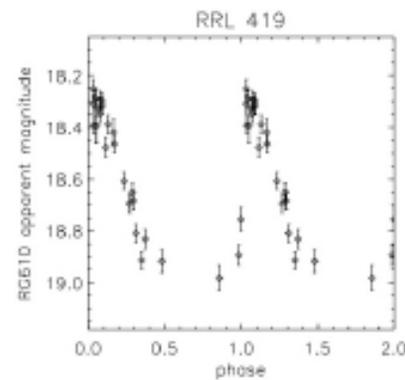
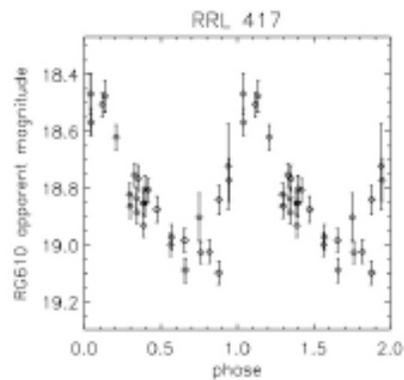
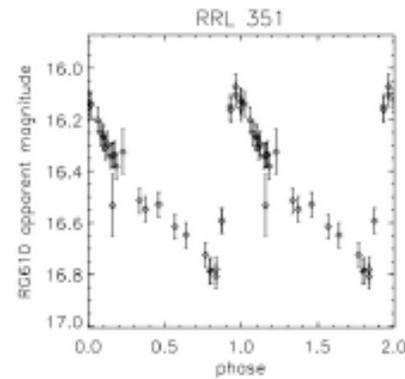
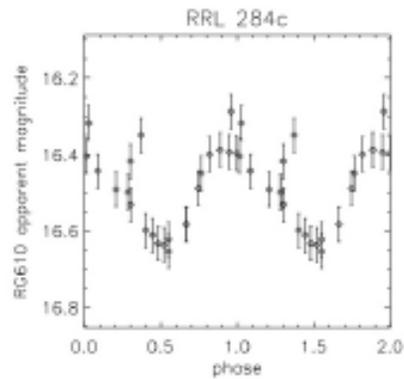
Database holds information about

- **processed images** (result from processing raw images),
- **calibration data** (used to process the raw images),
- **deep reference images** (result from co-adding processed images);
- **objects** found in references (soon).

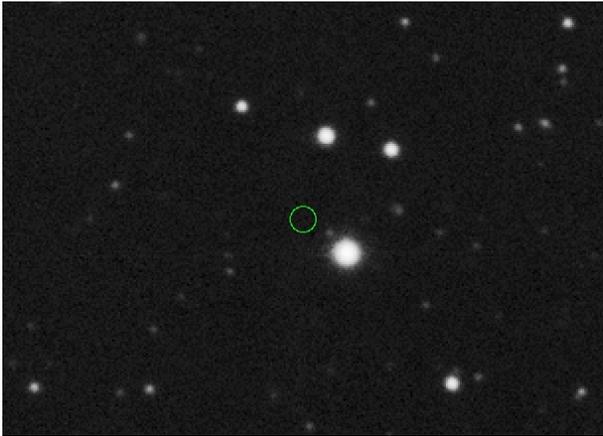
Postgres 8.2.7 (open source) used for the DBMS. Postgres performance better than MySQL performance with transaction management and foreign key constraints implemented (InnoDB storage engine).

The Deep Sky database will be used to:

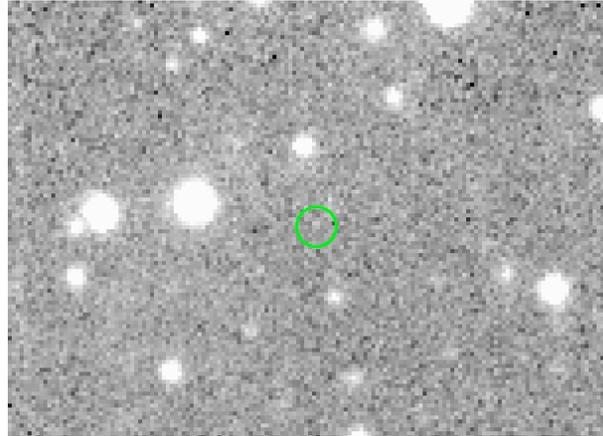
- check the quality of the images produced by the processing pipeline;
- get the list of processed images to be co-added to produce a deep reference image;
- retrieve the deep reference image and processed images that correspond to user-specified RA and DEC values (database backend to the UI).



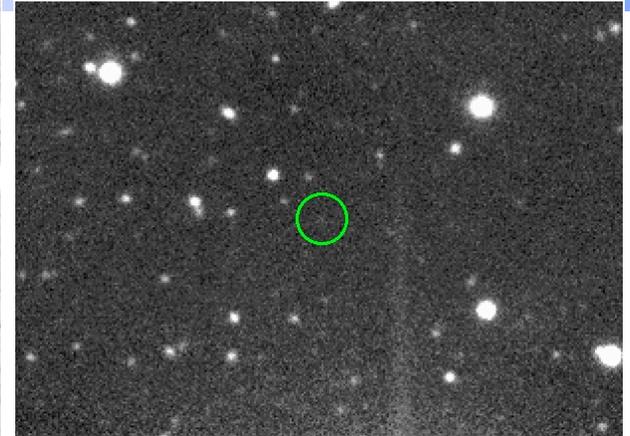
RR Lyrae searches are now being conducted on this dataset as well as building structure functions for QSO's.



GRB 070809



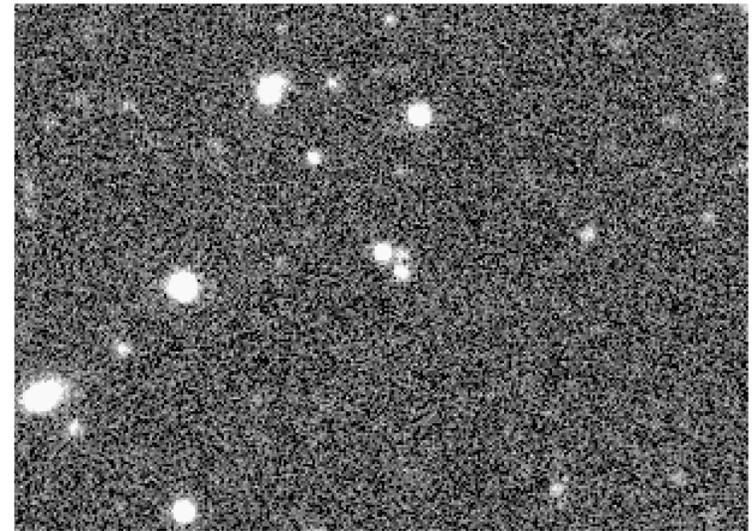
GRB 07112C



SNF 20070825-001

Limiting mag ~ 23.3

We have published several results in the Gamma Ray Bursts Coordinates Network Circulars and the Astronomer's Telegrams on the discovery (or limiting brightness) for many host galaxies of GRB's and/or supernovae. In addition we have used the time history of data to commence searches for variable blazars, QSO's, high proper motion stars and supernovae.



Just last month...

A Previous Transient Consistent with the Location of SN 2009ip Suggests that SN 2009ip is Not a Supernova

ATel #2183; [A. A. Miller \(UC Berkeley\)](#), [W. Li \(UC Berkeley\)](#), [P. E. Nugent \(LBNL\)](#), [J. S. Bloom \(UC Berkeley\)](#), [A. V. Filippenko \(UC Berkeley\)](#), and [A. T. Merritt \(UC Berkeley\)](#)
 on 1 Sep 2009; 23:13 UT
 Distributed as an Instant Email Notice (Transients)
 Password Certification: Weidong Li (weidong@astron.berkeley.edu)

SN 2009ip classification through DeepSky.

Subjects: Infra-Red, Optical, Novae, Supernovae, Transients, Variables, Stars
Referred to by ATel #: [2184](#)

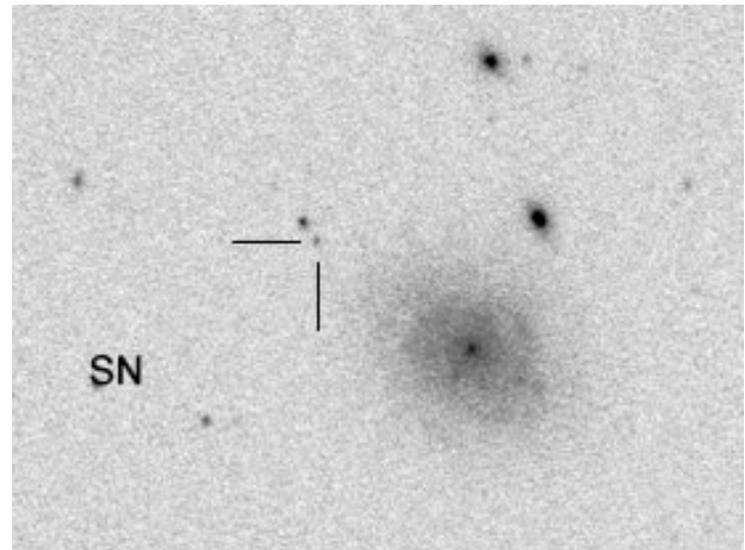
We have examined historical DeepSky (ATEL #[1213](#)) images of NGC 7259 and find that a transient consistent with the location of SN 2009ip (Maza et al. 2009; CBET [1928](#)) was present in 2005. Relative to USNO-B 1, preliminary photometry yields that the transient was at $R \sim 20.6$ mag on 2005 Jun 20 (UT dates are used throughout) and $R \sim 21.0$ mag on 2005 Jul 03. On a stacked image from 2008 Aug 23 we do not detect the transient down to $R \sim 22.0$ mag. Typical uncertainties when calibrating relative to USNO-B are 0.2 mag.

In a ground-based KAIT image taken on 2009 Aug 30, we measure SN 2009ip to have an unfiltered magnitude of 18.2, which corresponds to an absolute magnitude of $M \sim -13.7$ mag at the distance of NGC 7259.

We have downloaded an archival HST/WFPC2 image of the field which was taken on 1999 Jun 29 (HST proposal ID 6359). From an astrometric solution between the WFPC2 and KAIT images, we identified a potential progenitor for the transient at

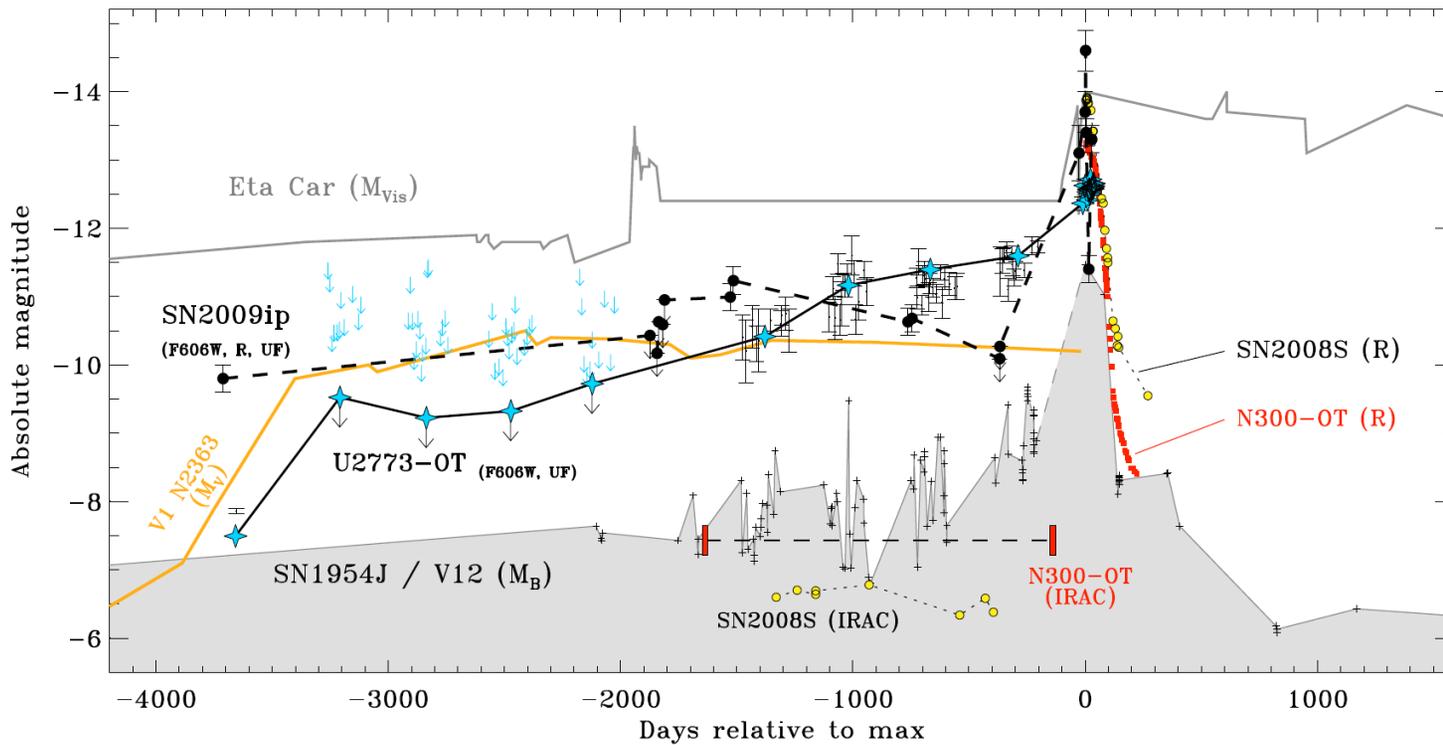
R.A. = 22:23:08.20, Decl. = -28:56:52.6 (J2000.0),

with $F606W = 21.8$ mag, which corresponds to an absolute magnitude of $M \sim -10.1$ mag at the distance of NGC 7259



Just last month...

SN 2009ip classification through DeepSky.



Just last month...

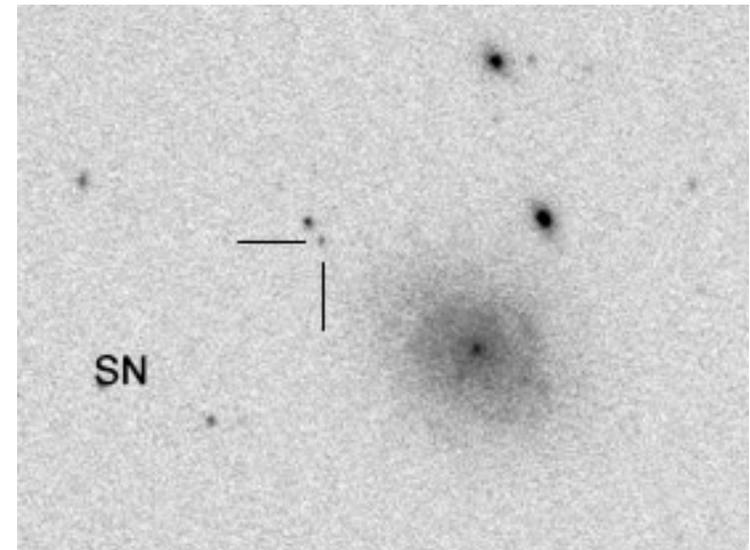
SN 2009ip classification through DeepSky.

SN 2009ip is an LBV Outburst

ATel #2184; [E. Berger, R. Foley \(Harvard\), and I. Ivans \(OCIW/Princeton\)](#)
 on 2 Sep 2009; 1:28 UT
 Distributed as an Instant Email Notice (Supernovae)
 Password Certification: Edo Berger (eberger@astro.princeton.edu)

Subjects: Optical, Novae, Supernovae, Transients

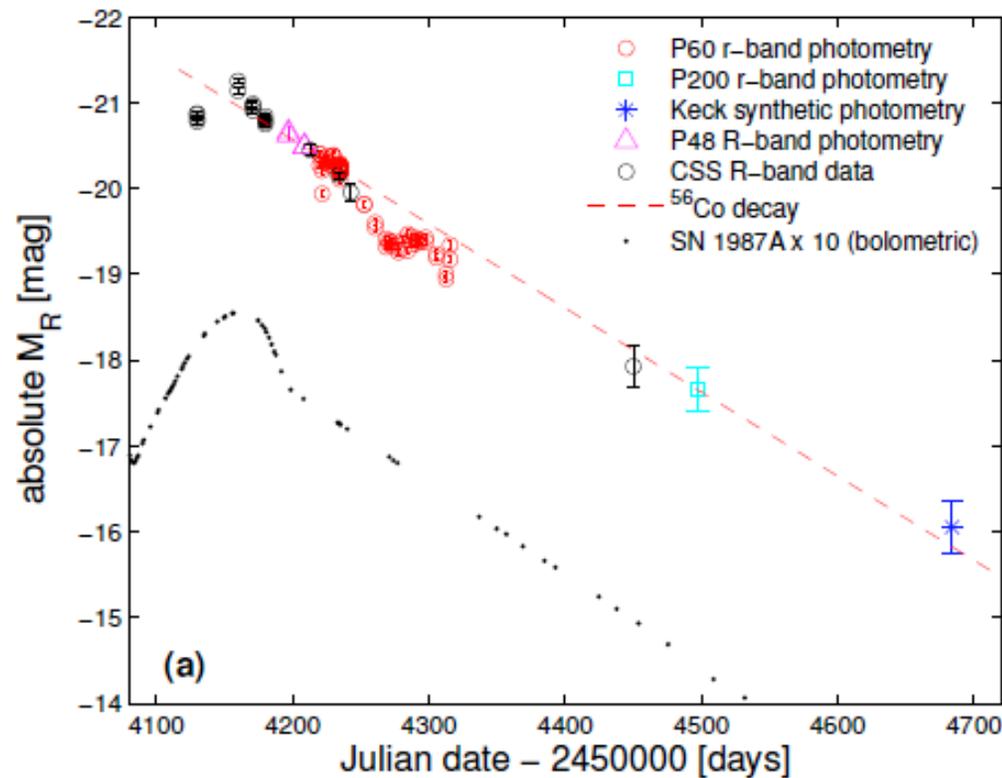
We obtained medium-resolution optical spectra of SN2009ip in NGC 7259 (CBET # [1928](#)) with the Magellan Echelle Spectrograph mounted on the Magellan/Clay 6.5-m telescope on 2009 September 1.24 UT. The spectra exhibit narrow (FWHM ~ 550 km/s) hydrogen Balmer emission lines centered at the systemic velocity of NGC 7259. These properties, along with a peak optical absolute magnitude of about -13.7 mag, previous variability at the same position, and a potential progenitor with $M \sim -10$ mag (ATEL # [2183](#)) indicate that SN2009ip is a luminous blue variable (LBV) outburst, similar to previous SN impostors such as SN1997bs (Van Dyk et al. 2000, PASP, 112, 1532).



Nature Paper (#1)

Nature paper accepted (Gal-Yam et al., 2009):

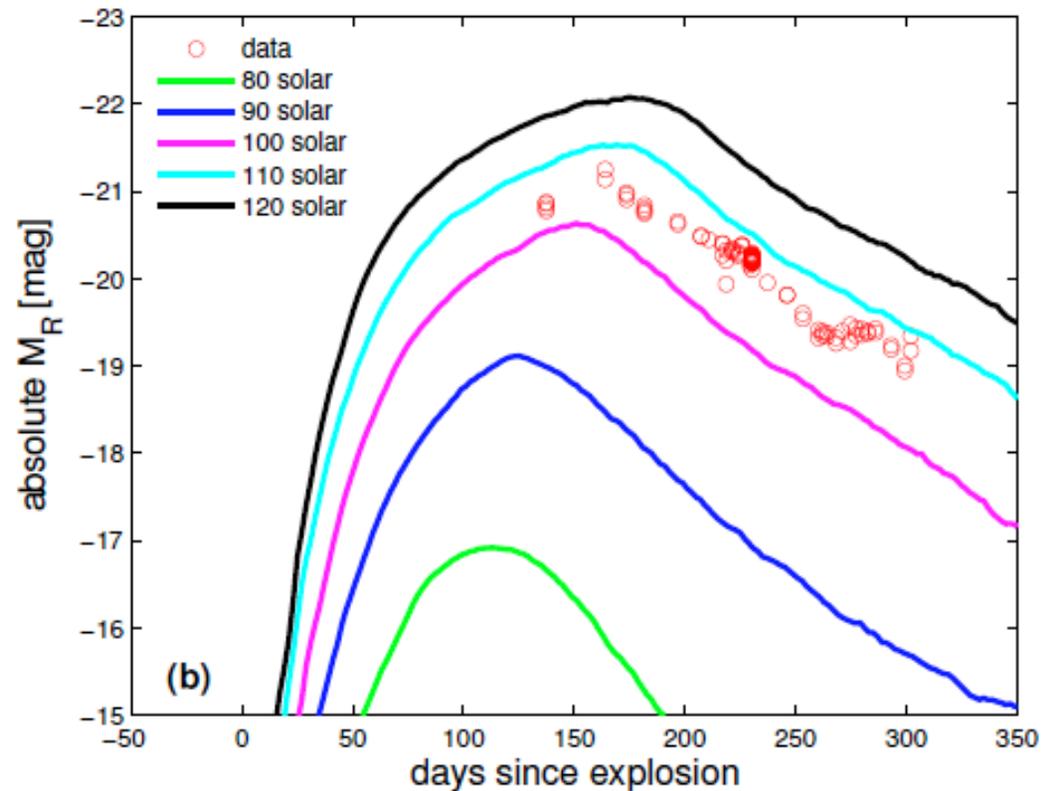
SN 2007bi: an explosion of an extremely massive star due to pair instability



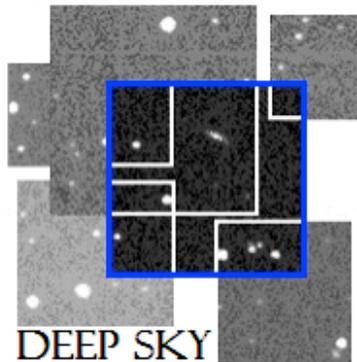
Nature Paper (#1)

Nature paper accepted (Gal-Yam et al., 2009):

SN 2007bi: an explosion of an extremely massive star due to pair instability



Web Server



The Deep Sky Project

Deep Sky is an astronomical image database of unprecedented depth, temporal breadth, and sky coverage. Image data are gathered from the Near Earth Asteroid Tracking (NEAT) project from the 3-CCD and Quest 112-CCD cameras on the Samuel Oschin telescope at the Palomar Observatory in San Diego County, California. Containing a total of nine million images, or 60 terabytes of image data, Deep Sky covers nearly the entire northern sky.

Deep Sky images cover:

- 20,000 square degrees,
- one decade of temporal coverage, consisting of eleven pointings on average at any given set of sky coordinates,
- image depth an order of magnitude greater than most other large sky surveys.

Query Deep Reference Images help

RA:258,DEC:27 ▼

Query By: RA/DEC Object Name

Size (arcsec):

RA (degree): Start date: 

DEC (degree): End date: 

Device Type

(All Devices)

Observation

Telescope

Instrument

<http://www.deepskyproject.org>



Conclusions

DeepSky has been a very successful demonstration of the power of Science Gateway Nodes:

- **Access to data repositories on NGF with a database interface**
- **Increasing the scientific value of large archival datasets to multiple NERSC repositories**
- **Providing NERSC processed data via the web to the public (future)**